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No. 889

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FUELS AND RELATED EQUIPMENT

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ANALYZING THE STRUCTURE OF OIL RESERVES

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 79 pp 34-37

[Article by E.M. Khalimov, deputy minister of the oil industry]

[Text] The first classification of the USSR's oil reserves was worked out by a commission that was specially created by the Geological Committee, in 1928, in order to carry out the first calculation of the oil reserves throughout the country [1]. It was suggested that the reserves be differentiated, according to the principle of authenticity (degree of study), into three categories: A -- prepared; B -- investigated; C -- proposed. This classification was later improved considerably by I.M. Gubkin, D.V. Golubyatnikov, V.V. Bilibin, M.V. Abramovich, M.A. Zhdanov, and other geologists.

All of the subsequent classifications (1932, 1937, 1942, 1953, and 1959) were also based on the originally substantiated principle of authenticity of reserves and the degree to which they had been studied.

The classification of resources that has been in effect in the USSR since 1970 is also based on the difference in the degree of the geological and geophysical study of fields, deposits and their individual parts, as well as structures (traps) and territories that are promising from the viewpoint of the existence of oil in them. It contains four categories of reserves (A, B, C_1, and C_2) and a group for the quantitative evaluation of predictions of the presence of oil (D).

Category A, B and C_1 reserves are calculated within the boundaries of a deposit with a proven oil content and are differentiated by the accuracy with which the calculative parameters have been determined. Category C_2 reserves include unsurveyed sections of deposits that have been discovered, promising horizons in known fields that have not yet had their oil content

established, and structures (traps) that are promising from the viewpoint of finding oil in them and are located in a region with an established presence of oil.

The existing classification has been widely and successfully used to plan geological exploration and surveying work and to calculate oil reserves. There have been attempts to use it in current and prospective planning for oil extraction. As experience has shown, however, the use of a classification of reserves based on the degree of their study when planning oil extraction frequently leads to serious errors.

In the first place, this is related to the fact that the calculations are based on a sum of reserves and resources that differ as far as their degrees of reliability are concerned. Methodological procedures to "equate" the reliability of the separate components of this sum by introducing correction factors do not increase the accuracy of the calculations, since the degree of substantiation of the correction factors is almost always inadequate. Secondly, even in a single category there are frequently very significant differences related to the conditions for development, the degree of possible recovery and the economic indicators of deposit exploitation. Besides this, another essential flaw in the practice of using the sum of the resources to plan oil extraction is the impossibility of distinguishing in these resources the percentage of the reserves that is suitable for increasing oil extraction and the percentage that is confined to old fields from which extraction is decreasing.

The Ministry of the Petroleum Industry made a careful analysis of the causes of the deviation of current and long-term oil extraction volumes from the calculated ones, by separate oil-producing regions, that makes it possible to draw two important conclusions.

1. Scientifically substantiated current and prospective oil-extraction planning should be done only with reserves from the industrial categories ($A + B + C_1$). On the basis of reserves in category C_2 and resources in category D, which are of an especially probabilistic type, only geological surveying work -- and not oil extraction -- can be planned. On the basis of these resources it is possible to make only a probable estimate of the volumes of oil extracted from deposits and fields that may be discovered during the planning period.

2. In order to increase the accuracy and degree of substantiation of the planning process, it is necessary to make a careful analysis of the structure of the reserves in the industrial

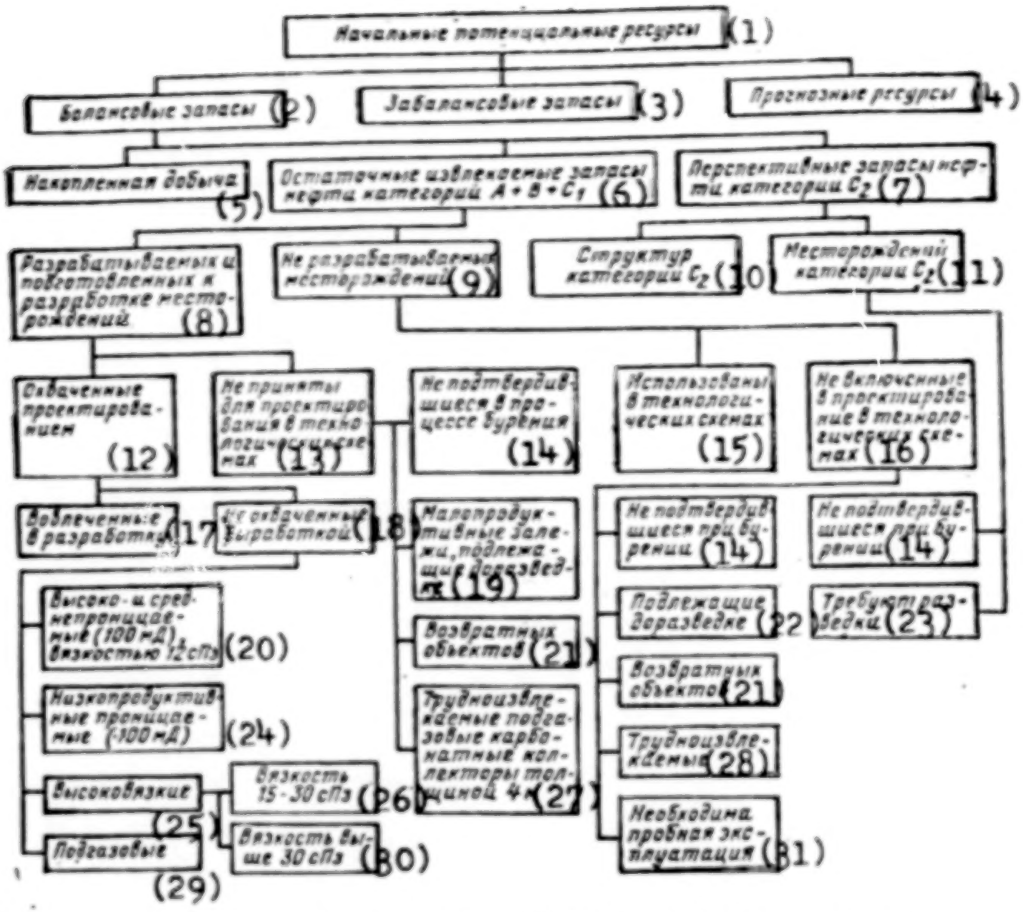


Figure 1. Proposed plan for differentiating oil reserves

Key:

1. Original potential resources
2. Balance reserves
3. Ex-balance reserves
4. Predicted resources
5. Stored production
6. Residual extractable oil reserves in categories A + + B + C_1
7. Prospective category C_2 oil reserves
8. Fields under development and ready for development
9. Fields not being developed
10. Category C_2 structures
11. Category C_2 deposits
12. Covered by planning
13. Not accepted for use in production plans
14. Not confirmed by drilling
17. Involved in development
18. Not involved in production
19. Low-yield deposits subject to final surveying
20. High and medium permeability (100 md), with viscosity of 12 cp
21. Recurring projects
22. Subject to final surveying
23. Require surveying
24. Low-productivity, permeable (less than 100 md)
25. High viscosity
26. Viscosity of 15-30 cp
27. Carbonaceous reservoirs 4 m thick that lie under gas, with oil that is difficult to extract
28. Oil that is difficult to extract

[Key continued on next page]

Key to Figure 1 (continued):

15. Used in production plans
16. Not included in production plans
29. Under gas
30. Viscosity above 30 cp
31. Test drilling needed

categories and to differentiate them not only with respect to the extent that they have been studied (using the existing classification), but also according to the qualitative characteristics of the oil, the surrounding rock, and the conditions under which the deposit must be developed. It is only this type of grouping of reserves that will make it possible to rigorously and scientifically substantiate the dynamics of oil extraction and make the necessary economic calculations for each oil-producing region and the branch as a whole.

The necessary experience in analyzing the structure of the reserves has been accumulated in the branch, and the plan that was proposed for differentiating them (see Figure 1) has been approved in some oil-producing regions of the country. Its use made it possible to analyze the structure of the oil reserves, substantiate the sequence in which new reserves are exploited, determine the path of development of scientific research work aimed at total extraction of the oil, and plan measures for increasing the efficiency of the development of fields already being exploited, as well as developing a strictly scientific approach to the economic substantiation of calculated indicators.

The original potential resources in an oil-producing region are supposed to be differentiated into three groups: balance, ex-balance and predicted.

The group of balance reserves includes stored oil production and residual reserves that are being extracted (categories A, B and C_1), as well as prospective reserves in fields and structures that are ready for drilling.

The group of ex-balance reserves in the industrial categories (A, B and C_1) includes reserves in individual deposits or sections in fields that are being developed or are being conserved, and from which it is impossible to extract the oil given the existing level of development technology and equipment.

The group of predicted resources includes the category D_1 and D_2 reserves in promising areas.

The residual extractable reserves in categories A + B + C_1, as confirmed by the USSR GKZ [State Commission on Mineral Resources] or the Ministry of the Petroleum Industry's Central

Commission on Reserves and counted in the VGF [All-Union Geological Fund] balance, are the basis for current and future planning. It is necessary to distinguish two subgroups of these reserves.

The first subgroup consists of reserves in fields that are being developed or are ready for development.

Using the available detailed geological descriptions of the areas, industrial geophysical information and the results of experimental and industrial development, we can include the following reserves in this subgroup.

1. Reserves in deposits that are included in production and development plans (covered by planning). Here it is useful to distinguish the following types of reserves: involved in active development by a system of wells and effects on the bed that is being realized; not being worked by a realized system of development. In order to determine the possible reserves for oil extraction, it is advisable to divide them, according to difficulty of extraction, into those confined to high- and medium-permeability beds with the oil's viscosity being less than 10 cp and those in beds with high-viscosity oil (with subcategories of oil with viscosities of 10-30 cp and more than 30 cp), the development conditions and systems of which differ substantially; low-productivity beds and those lying under gas deposits.

2. Reserves in fields that are being worked but for which there are no planning documents; these include:
reserves that were not confirmed during the drilling of the operating well system and that need to be registered;
reserves in beds and deposits with low productivity indicators and that require further work in final surveying and experimental operation in order to gather additional information for the purpose of scientifically substantiated development planning;
reserves in recurring horizons. These reserves usually occur in thin, low-productivity beds into which the drilling of an independent network of wells cannot be justified on an economic basis, while simultaneous exploitation along with the base horizons is not feasible because of the oil yield losses. As a rule, plans are made to develop recurring sites with recurring wells after the base horizon is depleted and flooded;
reserves that are difficult to extract and are confined to low-permeability carbonaceous reservoirs, water-and-oil zones lying along the edges of deposits, and areas under gas deposits, all of which have an oil-saturated thickness of less than 4 m. As many years of experience in working under different geological conditions and with different development systems have shown,

the extraction of oil from such reservoirs located in these types of zones is practically impossible without the drilling of special wells. However, the drilling of wells in these areas is not justifiable economically.

The second subgroup consists of surveyed reserves in undeveloped fields. By analogy with the first subgroup, here it is possible to distinguish reserves included in production and development plans (covered by planning) and those not covered by current specific planning. The latter include:
reserves not confirmed during final surveying or located in sanitary, protected or other areas where well drilling is forbidden and that are subject to registration or transfer into the ex-balance reserves;
reserves in deposits that require additional surveying in order to amass the practical geological and geophysical information needed for planning purposes;
reserves in recurring horizons, the involvement of which in development is possible after the basic reserves have been extracted from the base horizon (consequently, the need for detailed planning of their development will arise in the future);
reserves in thin and low-productivity reservoirs that are difficult to extract;
reserves in deposits that are awaiting experimental industrial exploitation and the results of industrial hydrodynamic investigations of the wells, which are needed for scientifically substantiated development planning.

It is recommended that prospective reserves (C_2) from the group of balance reserves be used to plan geological surveying work and to increase the oil reserves in the industrial categories. They are divided into reserves confined to deposits in recurring development sites and that require confirmation by drilling, and those that were not confirmed during drilling into the base horizons and have yet to be registered.

The proposed plan was used to analyze the structure of the reserves in one of the basic oil-producing regions in the Urals-Volga area. The analysis was carried out by V.M. Yudin, R.Kh. Khabibullin, Yu.A. Dulepov, V.D. Viktorin, I.N. Shustef, V.M. Gusev, V.G. Zvezdin, and N.N. Markov, and made it possible to achieve a substantial refinement in the calculations, substantiate the actual oil extraction volumes for the region, carry out timely planning and adoption of measures to bring new oil reserves under development, and compile and refine the planning documentation for development and equipment and for calculating and recalculating the oil reserves.

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DEVELOPING RESERVOIRS IN ROMASHKINO FIELD

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 79 pp 37-43

[Article by G.M. Akhmadiyev and R.Kh. Muslimov, Association of the Petroleum Industry of the Tatarskaya ASSR, R. N. Ilyashev and N.G. Zaynullin, TatNIPIneft', and A.M. Rudakov and A.I. Tkachenko, Al'met'yeneft' Petroleum and Gas Production Administration]

[Text] An industrial experiment was conducted in 1974 and 1975 in a section of the Al'met'yevskaya area of the Romashkino field, for the purpose of introducing an intensive system of development in order to bring into active exploitation the oil reserves in low-productivity reservoirs. The goals and first results of this work have been published in [1,2].

In this article we discuss the effectiveness of the experiment's implementation (increasing the density of the network and the relationship of the injection and operating wells and raising the injection pressure), with differentiation as to beds and types of reservoirs, and make recommendations about the introduction of an intensive system of development. The profitability of developing low-productivity reservoirs is evaluated, based on standardized bed parameters for the conditions encountered in oil fields in the Tatarskaya ASSR, as defined by TatNIPIneft'.

The integral characteristics of the dynamics of the introduction of the experiment in the section are shown in Figure 1. From the figure it is obvious that at the end of 1975 there was a sharp increase in the rate of total injection increase (curve 6) as a result of the introduction of new injection points (curve 1) and the increase in injection pressure (curve 3). There was an analogous change in the accumulated output (curve 2). The number of operating wells (curve 5) and the average formation pressure in them throughout the D_0 bed (curve 4) both

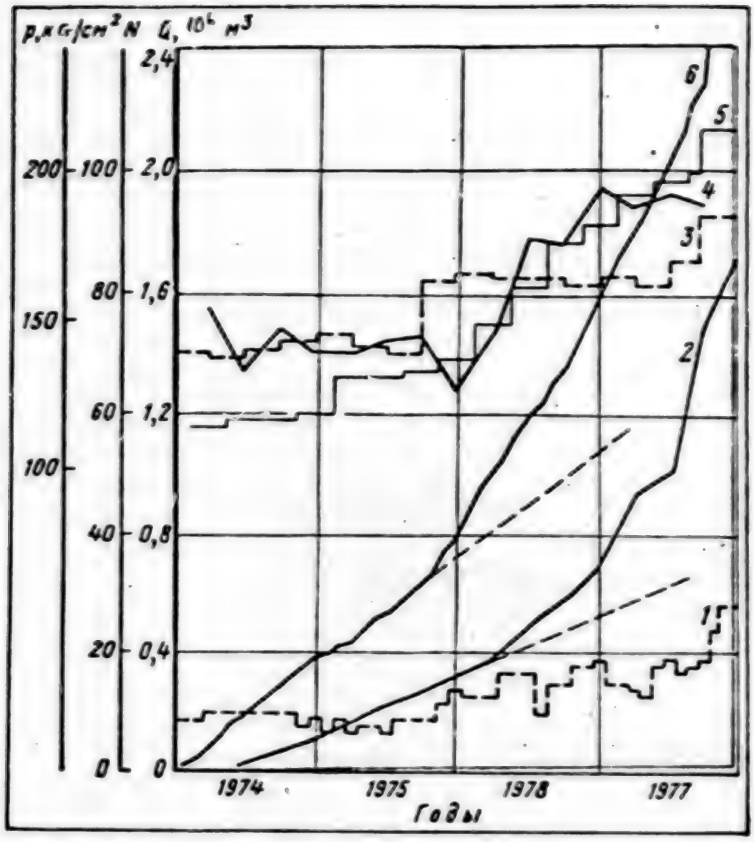


Figure 1. Indicators of intensive development of low-productivity reservoirs in the experimental section of the Al'met'yevskaya area: 1. introduction of new injection points; 2. accumulated output; 3. injection pressure; 4. average D_0 bed formation pressure in the operating wells; 5. number of operating wells; 6. rate of total injection increase.

increased. By 1 October 1977, an additional 28 operating and 19 injection wells had been drilled in the section. By the middle of 1977, an additional 860,000 m^3 of water had been injected, producing 400,000 tons of oil, and by the end of the year these development indicators had risen to 1.82 million m^3 and 960,000 tons, respectively.

An examination of the dynamics of the injection process by beds and types of reservoirs shows that the basic part of the oil output (approximately 70 percent) and the increase in injection are attributable to the D_0 bed (Figure 2), and that they were caused by increasing the number of wells and raising the injection pressure. On 1 October 1977, the sandstones of the D_0 bed, which are penetrated by a large number of wells (curve 5), accounted for more than 88 percent of the water injected into the entire bed (curve 1). There was also a noticeable increase

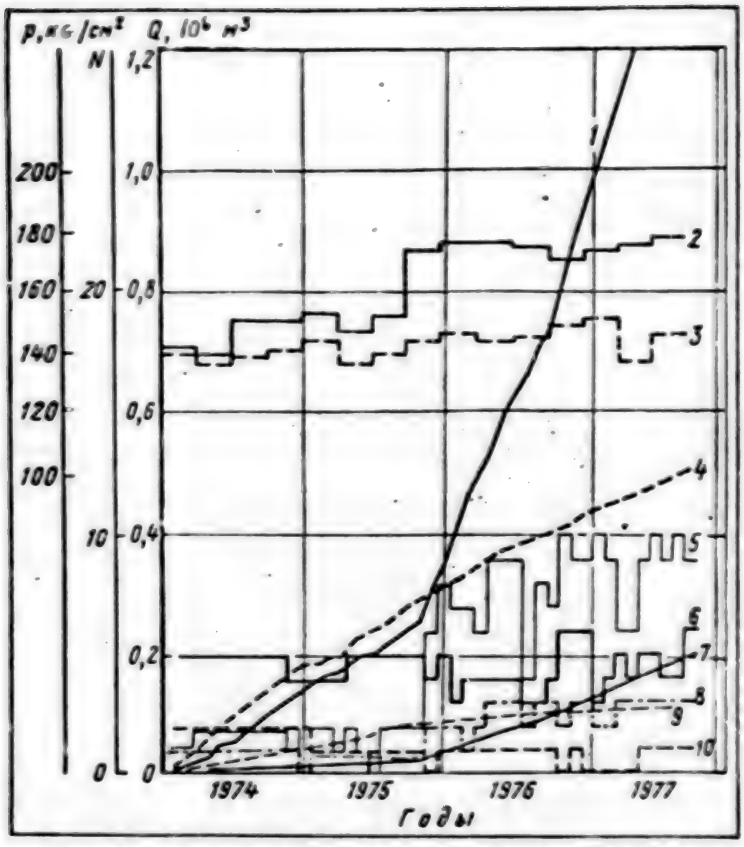


Figure 2. Injection dynamics by beds (D_0, b_3) and types of reservoirs (sandstones, aleurolites): 1. injection into D_0 bed (sandstones); 2,3. injection pressures for D_0 and b_3 beds, respectively; 4,7,9. accumulated injection for b_3 (sandstone), D_0 (aleurolite) and b_3 (aleurolite) beds, respectively; 5,8. number of wells into sandstones and aleurolites, respectively, of D_0 bed; 6,10. number of bed intersections for sandstones and aleurolites, respectively, in b_3 bed.

in the growth rate of the accumulated injection and for the D_0 aleurolite beds (curve 7).

For the b_3 bed as a whole and for both types of reservoirs in it, there was a slight drop in the rate of increase of the accumulated injection (curves 4 and 9) that was caused by the slight decrease in the number of active bed intersections (curves 6 and 10 for sandstones and aleurolites, respectively) while the injection pressure for the bed was kept constant (curve 3). On 1 October 1977, the sandstones in the b_3 bed accounted for about 80 percent of the total injection.

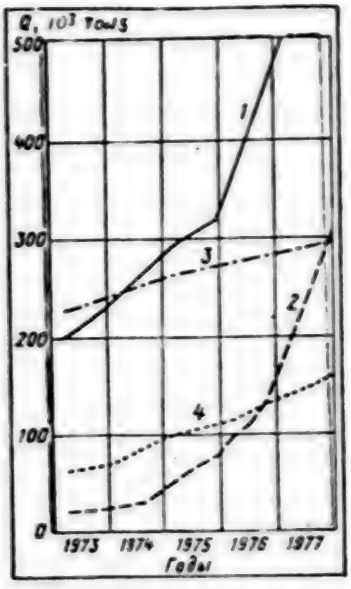


Figure 3. Extraction dynamics by beds and types of reservoirs: 1,2. sandstones and aleurolites, respectively, of D_0 bed; 3,4. sandstones and aleurolites, respectively, of b_3 bed.

Oil extraction by types of reservoirs in the D_0 and b_3 beds corresponds completely to the injection of water (Figure 3): the amount extracted from the aleurolites is only one-fourth to one-fifth of that extracted from the sandstones; there was a significant increase in the rate of extraction from the sandstones and aleurolites of the D_0 bed (curves 1 and 2), whereas this was not seen for the b_3 bed (curves 3 and 4).

Thus, an examination of the integral characteristics of water injection and oil extraction for the experimental section shows the great effectiveness of introducing intensive development systems in sections containing low-productivity reservoirs, although the effect of the injection process on the b_3 bed is still insufficient.

Let us discuss in more detail the nature of the beds' functioning and their reservoir properties. For 18 of the new injection wells, composite information obtained with the help of geophysical methods is presented in Table 1, which also contains data on the opened, low-permeability a and b_1 beds. From the table, the following points are obvious.

1. On the average, all of the bed intersections are not very thick (h) and have relatively low permeability (k). The difference between the average permeability (k_{ave}) of the sandstones (on the high side) and the aleurolites (on the low side) is 36 and 38 percent, respectively, of the average permeability of all the beds. This indicates that the area in the experimental section is relatively homogeneous.

2. The average specific permeabilities for all the beds and for the sandstones and aleurolites separately, given an injection pressure at the face (P_f) that is about 90 percent of the rock pressure, are 79, 87 and 44 $m^3/(day \cdot m)$, respectively. The low specific receptivity of the sandstone beds, as well as the aleurolite ones, also confirms the relative homogeneity and low productivity of the beds constituting the injection area.

Table 1.

Пласт (1)	Число пластовых пересечений в нагнетательных скважинах (2)	h, м	%, %	k, мд	$h_{АЧ}$, м	$m_{АЧ}$, %	$k_{АЧ}$, мд	Число работающих пластов в нагнетательных скважинах (3)	$Q_{АЧ}$, м³/сут	$p_{г\ АЧ}$, кг/см²
$Д_0$ (4)	14	1,2—5,0	13—24	50—400	2,9	19	200	14	233	379,8
в том числе: (5)										
(6) песчаники	9	2,2—5,0	16—24	120—400	3,3	20,5	244	9	320	375,0
алевролиты (7)	5	1,2—3,6	13—20	50—200	2,2	17	131	5	75	389,6
$б_3$ (8)	8	1,2—3,0	14—20	60—270	1,9	17	135	6	173	380,8
в том числе: (5)										
(6) песчаники	4	1,4—3,0	17—20	130—270	2,0	19	175	4	206	389,0
алевролиты (7)	4	1,2—2,8	14—17	60—180	1,9	17	112	2	106	378,5
а,	9	1,0—3,4	11—24	40—250	1,9	15	120	5	72	383,0
в том числе: (5)										
(6) песчаники	3	1,6—3,4	23—24	190—250	2,7	22	233	3	66	387,0
алевролиты (7)	6	1,0—1,8	11—18	40—120	1,5	12	63	2	80	381,6
$б_1$ (9)	7	1,0—3,8	14—25	50—300	2,2	17	156	7	163	384,5
в том числе: (5)										
(6) песчаники	5	1,4—3,8	14—25	160—300	2,4	20	208	5	203	383,0
алевролиты (7)	2	1,0—2,2	13—16	50—160	1,6	14	87	2	63	387,5
Всего (10)	38	1,0—5,0	11—25	40—400	2,3	17	163	32	181	382,0
песчаников (6)	21	1,4—5,0	14—25	120—400	2,7	20	223	21	235	384,0
алевролитов (7)	17	1,0—3,6	11—20	40—200	1,8	15	101	11	79	385,0

Table 2.

Пласт (1)	Число пластовых пересечений в эксплуатационных скважинах (11)	h, м	k, мд	$h_{АЧ}$, м	$k_{АЧ}$, мд	Число работающих пластов в эксплуатационных скважинах (12)	Работающие пласты (13)			Неработающие пласты (14)		
							$h_{АЧ}$, м	$k_{АЧ}$, мд	$l_{АЧ}$, м	$h_{АЧ}$, м	$k_{АЧ}$, мд	$l_{АЧ}$, м
$Д_0$ (4)	49	0,9—6,8	12—510	2,7	166	32	2,9	175	430	2,4	153	574
в том числе: (5)												
(6) песчаники	24	1,2—6,8	12—510	3,3	220	16	3,4	221	427	3,2	218	630
алевролиты (7)	25	0,9—3,6	40—500	2,2	109	16	2,5	121	433	1,9	88	518
$б_3$ (8)	30	1,2—3,4	32—370	1,8	140	15	1,9	176	563	1,6	112	660
в том числе: (5)												
(6) песчаники	11	1,2—2,8	50—370	1,7	211	3	1,8	236	664	1,6	135	533
алевролиты (7)	19	1,2—3,4	32—170	1,8	102	7	2,0	87	462	1,6	108	788
Всего (10)	79	0,9—6,8	12—510	2,3	156	47	2,4	175	496	2,0	133	617
песчаников (6)	35	1,2—6,8	12—510	2,8	217	24	2,8	225	546	2,8	195	582
алевролитов (7)	44	0,9—3,6	32—500	2,0	106	23	2,3	110	447	1,8	99	603

[Key on next page]

Key to Tables 1 and 2:

1. Bed
2. Number of bed intersections in injection wells
3. Number of working beds in injection wells
4. D_0
5. Including:
6. Sandstones
7. Aleurolites
8. b_3
9. b_1
10. Total
11. Number of bed intersections in working wells
12. Number of working beds in working wells
13. Working beds
14. Nonworking beds

3. Investigations carried out with deepset, remote-controlled flowmeters showed that discrete injection, at increased injection pressures, into beds with similar reservoir characteristics made it possible to exploit (by flooding) 84 percent of the discovered beds, including 100 percent of the sandstone and 65 percent of the aleurolite beds.

The following beds (35 percent of the aleurolite ones) turned out to be nonworking ones:
1) the bottom b_3 aleurolite bed (well 16491) in the injection area, with thickness h = 1.6 m and porosity m = 17 percent, the low receptivity of which could not be determined because of the low sensitivity of the RGD-4 flowmeter used to investigate the well. On the basis of the average parameters, it should be expected that this bed's receptivity can prove to be lower than the instrument's sensitivity threshold;
2) b_3 (well 10050) and a (wells 16489, 16499 and 16503), the lack of receptivity of which is explained by their poor reservoir properties (their hydraulic conductivity, as determined with the help of geophysical methods, is 5-7 d·cm/cp). Although a well-bottom pressure of 385 kg/cm^2 was reached, these beds could not be exploited by injection;
3) a (well 10050), with a conductivity figure of 19.2 d·cm, which also was not exploitable by injection at a well-bottom injection pressure of 320 kg/cm^2. A further increase in the injection pressure, up to the level of the rock pressure, is related to the fact that in this well there exists another D_0 bed in the injection area that has greater conductivity (55 d·cm) and receptivity that increases sharply as the pressure does. Since this increases the hydraulic losses in the well and makes it difficult to achieve the pressure needed to exploit the well by injection into bed a, discrete injection into these beds is required.

For the injection wells as a whole, the average thickness of the beds receiving water was 2.1 m, their porosity was 19.1 percent, and their permeability was 174 md; the same parameters for the beds that did not accept water were 1.6 m, 13.0 percent

and 65 md (the parameters presented here were obtained from geophysical data).

Composite data on the basic beds that were exploited by the operating wells (D_0 and b_3) are presented in Table 2, from which the following points are obvious.

1. The number of working bed intersections (65 and 50 percent, respectively, for the D_0 and b_3 beds) is considerably less than in the injection wells, although the average permeability and thickness of these beds in the injection and operating wells differ only insignificantly (see Table 1). The smaller proportion of working b_3 beds is explained not only by the fact that it has poorer reservoir properties and is at a greater distance (ℓ) from the injection zone than the D_0 beds, but also by the smaller amount of water injected into it.

2. The dependence of the presence or absence of an influx from the beds on their permeability and distance from the injection zone can be traced quite clearly. For instance, groups of working and nonworking D_0 sandstone beds that differ little as far as permeability is concerned do differ considerably in distance from the injection zone (427 and 630 m, respectively). The b_3 sandstone beds with higher permeability (236 md) operate at great distances from the injection zone (664 m), while those with less permeability do not function even at lesser distances (533 m). Consequently, as a rule the productive beds are zonally heterogeneous, so the network of wells over the entire area of the field or deposit cannot be evenly spaced, as was assumed to be the case during planning.

The change in the number of bed intersections and the percentage of working beds in the operating wells that resulted from the introduction of the intensive development system in the section is shown in Table 3.

From the table it is apparent that in most of the wells, other beds were discovered along with the D_0 and b_3 beds, which were the ones being investigated. The effectiveness of the development intensification system is attested to by the fact that in comparison with 1973, in 1977 the number of D_0 and b_3 bed intersections increased by 38 and 20 percent, respectively, while the number of working beds increased by 146 and 36 percent, respectively.

For the D_0 bed in 1973, the average degree of flooding of the operating wells was 1.4 percent; in 1975 it was 18.1 percent and for 9 months of 1977 it was 52.1 percent. For the b_3 bed, the corresponding figures are 27.4, 19.1 and 66.8 percent.

Table 3.

Пласт (1)	Совместно эксплуатируемые (2)				Раздельно эксплуатируемые (3)			
	песчаники (4)		алевролиты (5)		песчаники (4)		алевролиты (5)	
	1973 г.	1977 г.	1973 г.	1977 г.	1973 г.	1977 г.	1973 г.	1977 г.
$Д_в$	10 (70)	16 (94)	17 (23)	25 (52)	3 (33)	3 (66)	4 (25)	3 (66)
$б_в$	8 (87)	11 (72)	10 (20)	10 (50)	—	—	2 (200)	3 (66)

Примечание. В скобках показана доля работающих пластов в %. (6)

Key:
1. Bed
2. Worked jointly
3. Worked separately
4. Sandstones
5. Aleurolites
6. Note: percentage of working beds given in parentheses.

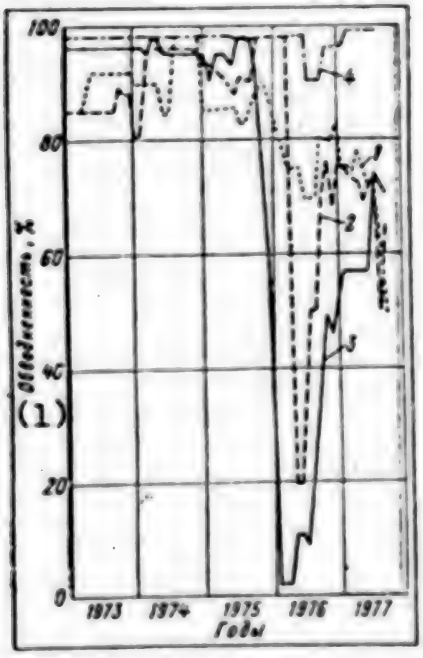


Figure 4. Change in the degree of flooding when flooding focal points were mastered: 1,2,3,4. wells 1914, 1989, 1981, and 1933, respectively.
Key: 1. Degree of flooding, %

...h the introduction of injection through the focal wells, this indicator decreased briefly for the nearest operating wells. This was probably caused by a change in the direction of the filtration flows in the bed. After that, the degree of flooding again increased (Figure 4). Consequently, intensification of the development of low-productivity beds must be combined with sequential cyclic injection into the focal wells.

Table 4 contains the results of hydrodynamic investigations of the injection wells.

The pressure recovery curves were worked out in semilogarithmic coordinates and by the technique used for fissured reservoirs [3]. The results of the processing showed that the hydraulic conductivity values obtained with respect to the

Table 4.

№ скважины (1)	Проводимость пласта, д·см (2)			(6) Дебит жидкости, м³/сут	(7) Приведенный радиус скважины, м	(8) Радиус раскрытия трещин, м	Давление, кгс/см² (9)		(12) Перепад давления, кгс/см²	Вскрытый пласт (13)
	по геофизическим данным (3)	по гидродинамическим методам исследования (4)	по методике [3] (5)				пластовое (10)	устьевое (11)		
10046	136,0	—	—	1560	5,20	8,0	—	112,0	—	$Д_0$. а. $б_1$
10049	66,6	35,4	51,70	450	8,50	16,3	—	167,0	—	$Д_0$. а
11276	101,9	51,8	21,14	176	1,14	12,6	143	187,0	44	$Д_0$. $б_1$
16492	—	10,75	18,50	90	9,50	24,4	192	212,0	40	$Д_0$. $б_1$
16493	63,6	11,75	9,60	90	5,76	31,0	187	232,0	45	$Д_0$. $б_1$
16503	196,4	21,5	15,10	360	1,40	17,9	113	213,2	120	$Д_0$. $б_1$
16503	196,4	11,9	10,86	250	1,19	8,3	113	194,4	81,4	$Д_0$. $б_1$
16505	139,8	38,8	24,70	430	10,41	89,0	160	215,0	55	$Д_0$. а
16505	139,8	29,4	20,50	325	9,90	81,8	160	204,0	44	$Д_0$. а
16505	139,8	21,7	17,46	215	9,80	57,3	160	192,8	32,8	$Д_0$. а
16509	60,6	6,46	6,85	105	3,30	14,6	116	203,6	90	$Д_0$
16509	60,6	3,5	3,99	59	1,90	6,00	116	196,8	80,8	$Д_0$
16509	60,6	1,23	1,30	18	1,07	1,5	116	188,0	72	$Д_0$
16509	60,6	17,4	14,50	230	4,60	47,3	—	228,0	—	$Д_0$
16497	83,0	10,27	15,10	80	6,30	11,4	143	208,0	65	$Д_0$. $б_1$. $б_2$
Среднее (14)	107,5	19,4	16,30	296	5,30	28,6	143	196,0	64	—

Key:
1. Well number
2. Bed conductivity, d·cm
3. From geophysical data
4. From hydrodynamic methods of investigation
5. By technique shown in [3]
6. Liquid flow rate, m^3/day
7. Adduced radius of well, m
8. Radius of fissure expansion, m
9. Pressure, kg/cm^2
10. Bed
11. Well mouth
12. Pressure differential, kg/cm^2
13. Involved bed
14. Average

pressure recovery curve with the help of both methods of interpretation were approximately the same, and average less than one-fifth of the figure for hydraulic conductivity as determined from geophysical data (see Table 4). In the investigations, the major portion of the water was injected into the D_0 bed, so the parameters obtained primarily characterize that bed.

Judging by the nature of the indicator diagrams, water injection takes place at a pressure greater than the fissure-expansion pressure in the well-bottom area of the bed. In each well, the fissure expansion radii -- as determined by the technique explained in [3] -- depend on the injection conditions and increase as the injection pressure does. The average fissure expansion radius, as determined by 13 investigations of 8 injection wells (without well 16505), was 15.5 m. Its sharp

increase in well 16505 cannot be explained on the basis of the data that are available. The adduced radius in all wells is greater by two orders than the bit radius, which is apparently due to the formation of fissures in the area of the bed around the well bottom.

The results of the interpretation of the pressure recovery curves for the operating wells showed that for the investigated section as a whole, the beds are characterized by low hydraulic conductivity (the average value for 40 wells was 16.3 d·cm/cp). As was the case for the injection wells, the average hydraulic conductivity as determined with the pressure recovery curve was one-third of the figure obtained with the help of the geophysical data. On the whole, the results of the hydrodynamic investigations of the wells showed that in the section of the Al'met'yevskaya area under discussion there are low-productivity reservoirs, although according to data gathered during the geophysical investigations, in some wells they are attributed to the sandstone beds.

In the area of several of the operating wells, by the end of 1977 the formation pressure had increased to 200 kg/cm^2 or more and, despite the beds' poor reservoir characteristics, more than 20 wells had become gushers.

In order to evaluate the effectiveness of the system of intensifying the development of low-productivity reservoirs by using a denser network of wells, the actual indicators for the D_0 and b_3 beds were compared with the minimum values of the conditional parameters of Devonian beds in deposits already being developed in the Tatarskaya ASSR. Research performed by TatNIPIneft' showed that the drilling of a new well and its operation are profitable if it has a certain minimum amount of reserves and the proper initial flow rate. For the D_0 bed, the relative actual indicators (determined with due consideration for the fact that the conditional parameters were taken as unity) were: area per well -- 1.53; minimum bed thickness -- 1.60. For the b_3 bed, the corresponding figures are 2.41 and 1.20. The initial flow rate of the wells was 3.37 for the two beds. The actual conditional parameters were regarded as average values for all the wells drilled in the section. This was justified by the fact that an insignificant amount of reserves had been removed from the section by the beginning of the experiment.

From the data that have been presented it is obvious that from the viewpoint of profitability in drilling and operating them, the well placement system has a significant safety factor that increases if we allow for the presence of the oil reserves in the other low-productivity beds (a and b_1). The high initial flow rates and their tendency to increase with time are

explained by the increase in the formation pressure in the section being investigated.

Thus, this analysis of the introduction of an intensive system for working the reserves in low-productivity reservoirs has demonstrated its high efficiency. The results of the analysis can be used to plan an independent system for developing relatively homogeneous low-productivity beds.

Conclusions

1. According to data gathered during hydrodynamic investigations, 92 percent of the beds receive water when an independent injection system is used with the low-productivity D_0 and b_3 beds, which have an average conductivity of 15-20 d·cm. Under these injection conditions, the permeability of the beds that do not accept the water is only one-third that of the ones that do.

2. The proportion of working D_0 and b_3 beds in the operating wells is 65 and 50 percent, respectively. Their participation in the oil-producing operations is determined by the bed's permeability (k) and the distance along the bed from the injection zone to the oil removal zone (ℓ). The following figures can be used as a guide for the practical introduction of a system for the intensive development of low-productivity beds in the D_0 and D_1 horizons: $k = 110$ md, $\ell = 450$ m; $k = 175$ md, $\ell = 500$ m; $k = 225$ md, $\ell = 550$ m.

3. The profitability of an independent system for developing low-productivity beds in the D_0 and D_1 horizons in areas of oil fields in the Tatarskaya ASSR that already have equipment in place, given the injection pressures and well network described above, can be confirmed by comparing the actual and conditional parameters.

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11746
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MORE COAL FROM THE DONBASS REQUESTED

Moscow GUDOK in Russian 3 Jul 79 p 1

[Interview with the chief of the Donetsk Railroad V. V. Priklonskiy by special correspondent I. Vertel']

[Text] The CPSU Central Committee and the USSR Council of Ministers, as is known, adopted a decree to provide the national economy and the population with fuel, electric and thermal power during the fall-winter season of 1979-1980. An extremely important task has been posed: fulfill the annual tasks in production and transport of fuel and creation of reserves at electric power plants and industrial enterprises. The miners and railroad workers of the Donbass must make a weighty contribution to solving this problem. Our correspondent I. Vertel' requested the chief of the Donetsk Railroad V. V. Priklonskiy to tell how matters stand on the coal conveyor of this railroad. We publish his interview below.

Acting in close cooperation with the workers of spur tracks, the collective of the mainline shipped 587,000 tons of coal above the plan in May and the surplus exceeded 300,000 tons in June. But, unfortunately, we are becoming debtors at the beginning of the second six months. This debt was caused mainly by the winter. At that time we were very well fixed with open cars, both empties and with local freight. Moreover, the railroad was literally flooded all this time with malfunctioning rolling stock.

All our empty car preparation terminals are now operating at the maximum. But the residues of unsuitable cars are not being reduced: the regulating railroads are sending them to the Donbass as before "in flocks."

The railroad received no fewer rejected open cars in May and June than during the previous months. However, we still coped with the shipping plan and even surpassed it. How does one explain this? Primarily by the fact that supply in regulation has been appreciably improved. Moreover, the possibility has been created for leaving malfunctioning rail cars and repairing them without discernible losses.

And our railroad workers themselves are not sitting on their hands, they are energetically improving operational work and are universally increasing their own loading resources. One of the large reserves which are being used in this case is driving heavy trains. And whereas we previously did not fulfill the norm of the average weight of a train, we now surpass it by two tons. We are also overfulfilling the task on locomotive productivity by 30,000 gross ton-kilometers. As a result, the railroad has seemingly become wider and possibilities have appeared for maneuvering. The total turnover of rolling stock was accelerated by 0.14 day, while the turnover of open cars was accelerated by 0.08 day.

Unfortunately, there is still much to be desired with intraroad transfer and hauling of local freight. For example, we are underloading up to 500 rail cars at this time and half of them are the fault of the railroad workers. Transport of local freight is delaying the abundance of "windows" for track operations. On other days we must overcome up to 10-11 waysides. The situation on our main Slavyansk-Ilovaysk and Debal'tsevo-Krasnoarmaysk lines has now improved. Track operations there have been mainly completed. We will accelerate these operations on the other sections.

What can be said about the work of our coal-shipping stations? A competition of the coal-shipping complexes, which combines the efforts of all our subdivisions and customers, was begun in its time at the initiative of the collectives of the Makeyevka freight station and Shterovka. It is continuing even now. Many collectives are operating in a shock manner on the fuel conveyor and have thousands of above-plan tons on their account. Our static load exceeds the given load by 0.96 ton. More than 81,000 rail cars have been freed since the beginning of the year by doing this.

What are we now undertaking to implement the decree of the CPSU Central Committee and Council of Ministers? Coal production usually decreases in the mines during the summer months and the requests of the miners for empties decrease. This is not foreseen this year. First, approximately 1 million tons of coal is lying in piles and, second, a little more than 3 million tons of slurries -- an excellent fuel for electric power plants -- has been accumulated at the mines. It must be hauled out now while there is good weather. The Ministry of the Coal Industry of the Ukrainian SSR has decided to allocate additional equipment for loading the slurries and for hoisting the coal from the piles. We plan to ship 500,000-600,000 tons of slurries and no fewer than 400,000 tons of coal from the piles monthly. This will permit the railroad collective not only to fulfill, but also to surpass the daily and monthly tasks. It only requires organization of uninterrupted supply of open cars for loading. We hope that the supply of empty cars will be just as rhythmic then as now. We will do everything in our power to increase the efficiency of utilizing the transport facilities.

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LIQUIFIED PROPANE FUEL FOR VEHICLES

Moscow IZVESTIYA in Russian 20 Jun 79 p 2

[Interview with Viktor Ivanovich Karzinin by special correspondent A. Nikitin at Vologda]

[Text] There is a motor vehicle base of the Northern Railroad at Vologda. A total of 107 of its 115 vehicles run on liquified propane-butane gas rather than gasoline. The automotive base has its own service station. Our special correspondent A. Nikitin conducted an interview with one of the chief innovators of "gasification" of the station Viktor Ivanovich Karzinin.

[Question] What are the advantages of gas fuel?

[Answer] Primarily in lower cost. A kilogram of gas costs us 6.17 kopecks. A liter of A-76 gasoline costs us 15 kopecks. But fuel consumption over 100 kilometers of mileage is approximately identical.

We recently re-equipped 12 vehicles of marks GAZ-53A, GAZ-52 and ZIL-MM3555 to run on gas. The net saving from this measure will comprise more than 1,000 rubles annually per vehicle, that is, we will save the cost of six new trucks on the fuel. Moreover, the air is not polluted since combustion is more complete.

Propane-butane is not so scarce, especially recently. After all, natural gas has come to many cities. The consumption of liquified gas was reduced there. Many service stations were left idle. And the gas suppliers -- the petroleum refining plants -- sometimes have difficulty with service.

[Question] How does gas fuel affect the operation of the engine?

[Answer] There is less detonation, the engine operates easier and it seems will run longer. It is theoretically assumed that the capacity of the engine is reduced somewhat, but we have not noted this in practice.

[Question] And how do the drivers feel toward gasified vehicles?

[Answer] If you suggest to one of our drivers to convert to gasoline, he will hardly agree. After all, we have no problem with overconsumption of fuel. Our drivers receive a slight bonus for servicing gas equipment. If they follow it carefully, gas leaks and related malfunctions do not occur.

[Question] One can see vehicles with red tanks in other cities, but I have heard that they have the following deficiency: they cannot travel far from the service stations. Therefore, your experience is obviously good only for motor vehicle bases with a "short run."

[Answer] Nothing of the kind! The fact is that our vehicles are universal. They can operate either on gas or on gasoline.

Our drivers travel to other cities for a thousand or more kilometers. As an experiment we have sent a vehicle to Moscow only on gas, with two tanks. It travelled there and returned excellently without refueling. But generally the universality of the vehicle and its capability of converting from one fuel to another is, I feel, a great advantage. And in this regard, I cannot understand at all why the automotive builders do not desire to make use of our experience.

I recently travelled to the Ryazan' Motor Vehicle Equipment Plant. We receive spare parts from there for re-equipping our own vehicles. This plant does a great service -- it adapts transport for operating on gas. But why does it make it so that the vehicle can operate only on gas? In this case the plant expends much more metal and labor than we do. They modify the engine there. And we reconstruct only the carburetor. We take only the tanks, evaporators and reducers from the set of equipment supplied by the plant. The rest goes to the warehouse.

Re-equipping vehicles according to our method is possible for every automotive base. It requires three mechanics and two days of work.

[Question] Light truck transport predominates in the large cities. Is it also not possible to re-equip light vehicles by your method?

[Answer] I think it is possible. In our time we have successfully "gasified" at least Pobedas, Emkas and similar old marks and have placed the tanks in the trunk.

[Question] You mentioned the Pobedas and Emkas. Has your motor vehicle base been operating for a long time on gas?

[Answer] Since 1949. We railroad workers had it very rough at that time with fuel. Therefore, we became involved with gas. We constructed our own gas filling station, developed methods of re-equipping the vehicles and

worked out instructions on refueling and operation. There is little literature on this problem in the country even now and at that time there was absolutely none. We had to play much of it by ear.

[Question] Your experience has probably been widely distributed and encouraged?

[Answer] Yes, we four -- the chief of the motor vehicle base L. Sorokin, the chief engineer I. Vtorov, mechanic F. Bukhlanov and I -- were awarded a prize for the innovation. There were several comments in GUDOK and in our railroad newsletter. I wrote a book about operation of vehicles that operate on gas, but the publishing houses were not interested in it.

I think that wide dissemination of this experience is being delayed by two circumstances. First, our motor vehicle base is small. It happens that they come for experience and ask how many vehicles we have. "Approximately 100." "Ah, but we have more than 1,000." And second, we are an agency motor vehicle base. We are a small part of an enormous auxiliary facility for MPS [Ministry of Railways]. The railroad workers have their own concerns and the railroads have enough concerns. Progress in automotive transport does not excite them very much, while the specialized automotive agencies obviously feel that we have our own specifics here and that our experience is not applicable to them.

[Question] Are there vehicles operating on gas in other motor vehicle facilities of Vologda?

[Answer] I have never encountered them at our own station and there is nowhere else for them to refuel. Our station could refuel twice as many vehicles as now, but I recall only one case when our colleagues -- the gas suppliers -- turned to us for assistance in re-equipping vehicles to operate on gas. They transport gas tanks on gasoline vehicles throughout the entire oblast. We helped them to re-equip one vehicle.

[Question] Incidentally, about your gas refueling station. Was it difficult to develop it and was it expensive to build it?

[Answer] It was very difficult to build: this is a former swamp and it cost 74,000 new rubles. The annual saving on fuel is repaying the cost with interest. This is a simple facility: two tanks with compressors, a pair of pumps in a small room and a very short railroad branch.

[Question] Does this station have any prospects? Will it be expanded?

[Answer] There are no prospects whatever. A new mikrorayon is being planned on this location, the station will be removed and the new railroad will hardly build it. I repeat again: we are only an insignificant part of an auxiliary facility for the railroad workers. At one time the diesel shunting locomotives were refueled with gas, but they have now been replaced with diesel shunting

locomotives. If the motor vehicle drivers, the Ministry of Motor Vehicle Transport of the RSFSR were interested in our experience, the station's fate would probably be quite different.

6521
CSO: 1822

GAS CONDENSATE AS A MOTOR VEHICLE FUEL

Moscow PRAVDA in Russian 3 Jul 79 p 3

[Article by T. Fetisov: "A New Type of Motor Fuel is Being Created from 'White Oil'"]

[Excerpts] Of course, the greater part of the condensate in the country is now collected and shipped for refining. But at points remote from transport arteries, no matter how it hurts, it is burned off -- after all, it is impossible to pump the condensate together with a gas since it rapidly clogs the pipes. For example, all the condensate produced at that time -- approximately 260,000 tons -- had to be burned off in 1968 after the Vuktyl gas field (Komi ASSR) became operational.

The smoky fires at the fields have now diminished: legislative acts directed toward conservation of the interior, the atmosphere and the environment in general have forced extinction of many of them. But a large amount of gas condensate is still not being utilized. Thus, more than 2 million of 12.5 million tons of condensate coming from the beds with gas were not refined in 1978. This is of course not thrifty. Condensate is a valuable natural product and we are obligated to treat it carefully and to utilize its reserves efficiently.

Unfortunately, solution of the problem is still being delayed. It is expensive to lay condensate pipelines from fields with insignificant volume of condensate production and those located in remote regions.

They had just begun to organize operations in the Ob' area when comments appeared in the newspapers that keen-witted drivers began to fill their tractors, truck tractors and trucks with condensate (they still called it "white oil"). True, these reports later disappeared, but they are remembered.

A severe situation with fuel for diesel transport developed in the winter of 1968 in the Komi ASSR in construction of the "Siyaniye Severa" gas pipeline. Yakov Fedorovich Polonskiy, the chief engineer of the Ukhtastroy Trust, invited Eduard Vasil'yevich P'yadichev, the dean of the Oil and Gas Field

Department of the Ukhta Industrial Institute, and a fuel specialist to come see him:

"Help me if you can -- there is only enough fuel for 2 months and no more can be brought in before spring. At one time I assumed that they attempted to fuel the equipment in western Siberia with gas condensate. We also have a lot of it -- there is nowhere to put it."

"They can refuel with it or not," answered P'yadichev, "but there are no two condensates alike. Engines will fail rapidly from foreign fuel. Incidentally, there is a rational nucleus, but serious investigations and tests are required. Although there is little time, we will make a try."

Moving forward, I note that a solution was found and construction of the gas pipeline was not stopped for a single day. And that conversation laid the basis of difficult and many years scientific work, completion of which made it possible to solve one of the serious national economic problems -- to indicate methods for using gas condensate at remote and difficultly accessible fields as a fuel for diesel engines.

The contribution of the Tashkent HIghway Institute should be especially noted. Due to the attempts of the dean, meritorious scientist and technician of the Uzbek SSR, Doctor of Technical Sciences A. A. Mutalibov, a group of young scientists which he headed was formed. And E. V. P'yadichev was invited to work here.

The collective of Tashkent enthusiasts gave a new thrust to the investigations. Fuel specialists from different cities (associate professor of the Chelyabinsk Polytechnical Institute A. P. Stavrov, laboratory chief of the Leningrad Scientific Research Institute of Fuel Apparatus M. M. Vikhert, chief engineer of Ukhtastroy Trust Ya. F. Polonskiy, chief of the department of rig construction of Ukhta Geological Administration V. L. Peshikov, senior instructor of the Omsk SibADI (Siberian Highway Institute imeni V. V. Kuybyshev and others) supported the initiative of their Tashkent colleagues and headed loca groups in study of condensate.

One of the supervisors of the operations, E. V. P'yadichev, relates:

"A large complex of physicochemical investigations of condensates of different gas fields has recently been carried out. Methods of producing condensate fuels for diesel engines have been developed. Incidentally, similar operations are only beginning abroad. Our institute and the Chelyabinsk Polytechnical Institute have created drafts of the specifications for the new fuel. I note yet another thing -- analysis of gas condensates of our country showed that they can be used successfully as a fuel after simplified refining directly at the fields. In practice this means production of additional tens of thousands of tons of high-quality and inexpensive fuel!"

The topic of the scientific research, experimental and production work is truly diverse. It is sufficient to say that, besides careful study of the properties of the condensate itself, comparative, bench, wear, operating and road tests of truck, tractor and stationary diesels, including those installed on KrAZ and MAZ trucks and Ikarus busses, have been conducted.

The tests revealed many advantages of the new fuel compared with ordinary standard fuel. The engines operated normally according to comments of the mechanic-drivers and managers of the transport and drilling organizations. Thus, 55 stationary diesels at the Komineft' Association exceeded the motor potential by an average of 1,000 hours during testing of the new fuel and there are engines which have been operated without major overhaul 2-3 times longer than the established norms. Wear tests of the fuel apparatus of diesels also indicated an increase of motor potential by an average of 1,200 hours.

I would especially like to note that the experience of operating trucks and Ikarus busses in Tashkent and Bukhara showed a decrease of toxic exhaust gasses by 30-40 percent, the particulate content in them by half and carcinogen hydrocarbons by one-third. This is a very important achievement in the struggle for clean air!

The fruits of the investigations were put into practice at the Cherchik Bus and Taxi Park, Automotive Enterprise No. 61 of the Bukharaoblavtotrest [expansion unknown], the Ukhta Territorial Geological Administration, the Vuktylstroy Trust, the Ministry of Agriculture of the Komi ASSR, Glavkomigazneftestroy, Komigazstroy, Noril'skgazprom, Nadymgazprom and the Arkhangel'sk Geological Administration. The total saving from the use of condensate fuel exceeded 7 million rubles annually in these organizations.

Practice and the data of scientists show the high economy of the new fuel. Judge for yourselves -- the cost of a ton of diesel fuel, including expenditures for delivery of it, comprise 117 rubles at the Medvezh'ye field, 128 rubles at the Pechora-Kozhvin field, 170 rubles at the Urengoy field and 172 rubles at the Laya-Vozhsk field. Condensate fuel prepared directly in the fields is several times less expensive. The engines of a single drilling rig alone expend more than 3 tons of fuel daily. And how many drilling rigs are dispersed on our vast spaces?!

That is why the problem of converting all drilling rigs and fuels of remote regions and the transport servicing them to condensate fuel is so timely and it is also why experimental operation of trucks and busses should also be organized, the specialists feel. This is a real and completely achievable goal during the next few years. Even more so since small simple units for production of condensate fuel have been constructed or are being constructed at some truck-tractor parks and in fields of Central Asia, Siberia and the Arctic.

Thus, a condensate refining installation designed by the VNIIgaz Institute [All-Union Scientific Research Institute of Natural Gas] is being erected

at the Urengoy Field. It is planned to introduce another at the Naip Field. Designs of typical installations for extensive introduction will be developed from the results of their operation.

The confidence in such rapid and successful accomplishment of a posed problem is quite explainable. The use and distribution (as an experiment for the time being) of a new type of fuel, as is said, is proceeding smoothly: simplicity and accessibility, low cost and rapid economic return -- all this forces the producers and consumers to become the most active proponents of the scientists.

In giving great significance to this problem, Gosplan of the USSR adopted a decision to conduct extensive tests of the new fuel in 1979-1980 under the observation of specialists of Minavtoprom [Ministry of the Automotive Industry], Minsel'khozmash [Ministry of Machine Building for Animal Husbandry and Fodder production] and the Ministries of Automotive Transport of the RSFSR and Uzbekistan.

As a test, it has been suggested that the diesel truck and tractor fleet of Yamal Peninsula, Medvezh'ye, Urengoy and Vuktyl fields and also the diesel transport of Tashkent and Bukhara be converted to condensate fuel.

A decision on extensive use of the new fuel beginning in 1980 must be made from the results of this rather massive check by the State Interagency Committee on Testing Fuels, Oils, Lubricants and Special Fluids attached to Gosstandart of the USSR. Gas condensate diesel fuel will be introduced primarily in remote and difficultly accessible regions of the country.

So then, a practical beginning has been laid for an important and serious matter. Its future fate now depends largely on the actions of a number of ministries and agencies. Even brief enumeration of the problems requiring rapid solution shows that there is still much to be done. Especially many cares fall to the lot of Mingazprom [Ministry of the Gas Industry] -- the owner of the raw material. It must solve various problems in organization of production and deliveries of condensate fuel to customers.

There are also concerns in the scientific plan. Gas condensate, as the scientists assume, has still not revealed all its capabilities. Other types of fuel: gasoline, gas turbine and boiler fuels, may also be produced from those condensates not now being utilized. Obviously, the State Committee of the USSR on Science and Technology and other agencies should assist the Tashkent Motor Highway Institute and the Chelyabinsk Polytechnical Institute in organization of the appropriate laboratories.

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CHIEF ENGINEER OF ESTONIAN GRES COMMENTS ON USE OF SHALE FUEL

Tallin SOVETSKAYA ESTONIYA in Russian 24 Jul 79 p 2

[Interview with chief engineer of Estonian GRES M. Z. Gudkin by SOVETSKAYA ESTONIYA correspondent S. Tarakanov]

[Text] As is known, a large group of authors of the ESSR Academy of Sciences of the Central Boiler and Turbine Institute imeni I. Polzunov, Estonglavenergo [Estonian Main Power Supply Administration], the All-Union Production Association Krasnyy Kotel'shchik, the Estonian GRES, the Leningrad Branch of VGPI [All-Union State Planning Institute] Teploelektroproyekt and Severnergostroy Trust was nominated for the State Prize of the USSR of 1978 in the field of science and technology on the topic "Construction and development of the world's first large-capacity electric power plant operating on local shale fuel in the Estonian SSR." Today we are publishing an interview of our correspondent S. Tarakanov with one of the authors of the work, chief engineer of the Estonian GRES M. Z. Gudkin.

[Question] The world's first large-capacity electric power plants operating on shale fuel are undoubtedly the Pribaltiyskaya and Estonskaya GRES. A number of important national economic problems has been solved with construction and development of them. Please name the most important problems.

[Answer] First, fuel shales have been brought into the fuel-energy balance for the first time in the world and the technical capability and economic feasibility of using them in electric power engineering have been proven. And the technical and economic feasibility increases significantly with the increasing shortage and increase in cost of mazut.

Further, the use of shales from the Estonian field has made it possible to free regions of the Northwest from consumption of more than 65 million tons of acutely scarce imported fuel and to produce 166 billion kW-hours of electric power during the years of operation of the Pribaltiyskaya and Estonskaya GRES.

The problem of utilizing production wastes has also been solved. The shale ash is a good lime fertilizer which has found wide application in the agriculture of the Nonchernozem zone of the country. Complexes for collection, transport and mechanized loading of shale ash with total capacity of 4 million tons of this "fertility elixir" annually have now been created and developed at both plants. Moreover, the ash is used in construction materials production.

Construction of two shale power engineering giants at Narva has also altered the social face of the city. First, demographic equilibrium has been restored -- most residents in the city previously comprised females employed at the Krengol'mskaya Manufaktura Combine. Second, the city destroyed during the war was not only restored within the shortest periods, but has also increased significantly.

[Question] These are, so to speak, the global results of the creative efforts of many collectives of power engineering and machine builders, planning and scientific research institutes, builders, installers and operators who have found concentrated expression in your work. What do you feel are the main criteria for evaluating the work of the large author's collective submitted for the State Prize?

[Answer] These are the efficiency and quality of energy production. The power engineers know that almost 60 percent of the cost of electric power goes for the cost of fuel. Therefore, the main direction in reducing the cost of the product and consequently of increasing the efficiency of energy production is implementation of technical and organization measures directed both toward reducing fuel and electric power expenditures and toward increasing the reliability and output of equipment, which also directly affect the operating economy of the electric power plant as a whole.

[Question] Please tell me how these problems are being solved at the Estonian GRES.

[Answer] In 1977 the volume of electric power production exceeded the 1975 level by 1.456 billion kW-hr. During this period the consumption of comparison fuel was reduced by 5.8 grams per produced kW-hr and the consumption of electric power for our own needs was reduced by 0.86 percent. All this made it possible to reduce the cost of 1 kW-hr from 0.757 to 0.693 kopecks.

It may seem strange that we are talking about some insignificant values -- grams of fuel, fractions of a kopeck and of a percent. However, a reduction in the consumption of comparison fuel per produced kW-hr by even 1 gram yields a saving of 28,000 tons of shale -- tens of fully loaded rail cars -- with those volumes of electric power production which the Estonian GRES now provides annually. A reduction of electric power consumption for our own needs by 0.01 percent means almost 1 million kW-hr of electric power additionally produced for the national economy. One-hundredth of a kopeck saved in production of 1 kW-hr of electric power is 85,000 rubles of annual saving.

The Estonian GRES has now exceeded the design indicators in the volume of production and output of electric power and of its cost.

[Question] And in conclusion, can the scientific and technical problems solved in development of electric power plants operating on shale fuel be utilized in other regions of our country?

[Answer] I feel that they can, for example, in developing the richest Kansk-Achinsk lignite deposits.

The increased interest in this matter, manifested by foreign specialists, also give important significance to the achievements of shale power engineering.

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GETTING THE MOST OUT OF HEATING FUEL

Moscow IZVESTIYA in Russian 29 Jun 79 p 2

[Article by G. Filippov, minister of the fuel industry of the Belorussian SSR, candidate of technical sciences: "How to Save Heat"]

[Text] The decree of the CPSU Central Committee and the USSR Council of Ministers "On providing the national economy and the population with fuel, electric and thermal energy during the fall-winter season of 1979-1980" is yet another specific manifestation of the concerns of the Communist Party and the Soviet Government about the people and about maximum satisfaction of its increasing needs.

The problems of increasing fuel and energy production are identified in the decree. At the same time the problem of maximum saving of fuel resources in all sectors of the national economy are also formulated. Actually, a greater amount of fuel and energy can be saved and resources can be preserved with skillful management.

The production of fuel designed for the heating of individual and communal consumers and public buildings is increasing from year to year and is increasing both absolutely and relatively per capita. And even so, it is sometimes not enough, especially of service fuel.

The volumes of state purchases of "centralized" fuel are increasing with each year. But a way out of the situation can hardly by sought in this. Extensive opportunities for solving this problem are hidden in economising by fundamental improvement of those apparatus which burn fuel, converting it to the heat necessary for man. Thus we have directly approached the question of what modern furnaces should be.

This is a very timely question. The design features of existing furnaces do not permit efficient use of the chemical energy contained in fuel. Their efficiency comprises only 15-50 percent. In other words, the greatest amount of heat is carried away by so-called exhaust products of combustion -- smoke and soot. The heat escaping into the atmosphere can be retained and turned to the use of man only by using the most improved apparatus, such as, for

example, those which operate on gaseous, liquid or solid fuel. Their efficiency is much higher than everyday, ordinary furnaces. They make it possible to use hot water heating for buildings with considerably greater volume, they improve the hygienic conditions in buildings and they reduce the laboriousness of operations to service the heating devices. True, these apparatus require manual loading and purely intuitive determination of the amount of heat which must be burned to achieve comfortable temperature conditions. But there are also extremely few of them at present.

Experimental models of Ugolek-4M heating-boiler apparatus appeared comparatively recently. They were developed by the Institute of Fuel Minerals (IGR) of Minugleprom [Ministry of the Coal Industry] of the USSR and are manufactured by the Novomoskovsk Power Machinery Plant in Tul'skaya Oblast. Not only can dwellings be heated by using them, but hot water can also be produced for sanitary-hygienic needs and also for food preparation. Another advantage of the innovation is that fuel delivery in it is mechanized. One need only load the small hopper of the apparatus with fuel, set the necessary water temperature coming into the heating system on the indicator device and the "furnace" will maintain the given heating conditions for 8-10 hours. This is how long the hopper capacity is calculated for. But the main thing is the efficiency of the Ugolek-4M apparatus comprises 70 percent when operating on coal.

In 1978 the BelNIItoproyekt Institute [Expansion unknown] of the Ministry of the Fuel Industry of the Republic and the Institute of Fuel Minerals of the Ministry of the Coal Industry of the USSR conducted operational tests of the Ugolek units on dried granulated peat. It turned out that they operated excellently even on this type of fuel. Calculations made on the basis of the tests show that a minimum of 25 percent of fuel can be saved with conversion to apparatus of the given type.

But heat can be saved and this means the fuel itself can be saved only by improving the fireboxes. In fact, a tendency toward reducing the thickness of the outer walls of boating enclosures has been observed during the past two decades in architecture and construction. These designs are appropriate in regions with relatively warm climate. But is it feasible to distribute thin-walled enclosures with insufficient heat-insulating capability for buildings in the middle part of the country? Thin walls are the main "lattice" which passes heat from the buildings into the outside and IZVESTIYA wrote about this previously.

Or let us take yet another factor which disperses heat from dwellings. Many buildings come especially public buildings, are now made with enormous windows covering almost the entire wall. It is hot in these buildings in summer, the windows must be covered with drapes, while in winter almost half of all the heat escapes through the windows. The appearance of these "aquariums" possibly corresponds to modern architectural thoughts, but not from a practical viewpoint.

Let us discuss what we acquire by not optimizing wall thickness. Too, of course, brick and concrete are saved -- that is, sand and clay whose reserves are practically inexhaustible. But at the same time we lose heat, that is, gas, oil, coal and peat. But these reserves, alas, are not inexhaustible. This is what the town builders must think about even at the stage of designing new buildings. If they looked at the problem of human dwellings not only from architectural-structural aspects, but also from state aspects, we would possibly have different " aquariums" and perhaps they would be even smaller. Incidentally, glass with a special coating which contributes to reducing heat losses is already being installed in the windows of homes in some foreign countries and other design innovations are being used.

It must be said that the existing prices for fuel, like the methods of evaluating the economic effectiveness of architectural-structural solutions, heating and ventilation systems, do not contribute to selection of optimum, economic variants. Our costs for fuel are much lower than in other countries.

We are also losing a lot on unregulated ventilation systems. During the cold winter of 1978-1979, a reduction of air suction through the ventilation channels of the apartments of Minsk made it possible to achieve a significant reduction of heat losses and an increase of temperature inside the buildings.

Or perhaps let us take such a trivial thing as the stopcock on central heating radiators. Stopcocks are rarely found on a radiator. In combination with the low quality of regulating the intraquarter heating systems, this leads to sharply nonuniform heat distribution in the different regions of the city and individual buildings.

According to scientific data, overheating of a room by each excess degree is accompanied by an increase of fuel consumption and consequently of fuel by 4 percent. And up to 20 percent of the heat consumed for heating a building is lost through the wide open air vents. One asks, why heat the street? The ecological consequences of overconsumption of burned fuel should also be taken into account -- pollution of the air basin by combustion products is increasing in the zones of large cities.

In short, the problem of what a modern furnace should be is not quite a narrow agency problem. It should excite other than only the workers of the ministries of the fuel industry. Here is something for both the power engineers, machine builders, architects and scientists to think about.

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BRIEFS

GAS CONDENSATE--The gas condensate produced in the Bulla-More field has come in by pipeline to the pumping station. The new 30-kilometer pipeline laid along the bottom of the Caspian Sea is the third run which has linked the off-shore fields with the shore. It has successfully passed trials. The delivery of fuel will now be increased by one-third. [Text] [Moscow IZVESTIYA in Russian 24 Jun 79 p 1] 6521

COAL PRODUCTION--The powerful scraper conveyor developed at the Khar'kov Machine Building Plant Svet Shakhtera has given a good account of itself at the coal-mining enterprises. This unit, operating as part of a mechanized complex, is capable of transporting 600 tons of coal from the face each hour. The collective of the enterprise has now begun to fulfill the order of the miners of the Vorkuta Basin. Ten of these giant conveyors will be shipped prior to the end of this year to the northernmost mines of the country. [Text] [Moscow IZVESTIYA in Russian 24 Jun 79 p 2] 6521

ELECTRIC POWER PRODUCTION--The first unit of the Gusinoozerskaya GRES was run in in December 1976. At this time LEP-220 had already connected the energy systems of Buryatiya and Mongolia and current flowed along the line of friendship to the industrial sites of Erdenet and Darkhan. The turbine of the last unit of the plant has now been assembled and the auxiliary panels and units are being installed. The unit will produce current in September and the capacity of Gusinka will increase to 840 megawatts. The output of the plant will be brought up to 2,400 megawatts during the next five-year plan. [Text] [Moscow IZVESTIYA in Russian 27 Jun 79 p 1] 6521

GAS PRODUCTION--During the past several years alone, large gas fields -- Achak, Naib, Shatlik, Gugurtli and others -- have been discovered in Turkmeniya. They now supply the central industrial regions of the country with fuel. This photograph was taken at the pilot section of the Achak Gas Production Association Turkmengasprom [Photo not shown]. A total of 9 million cubic meters of gas is purified here within only 24 hours and is delivered through the Central Asia-Center Gas Pipeline. [Text] [Moscow IZVESTIYA in Russian 27 Jun 79 p 1] 6521

TRANSFER OF ADMINISTRATION--Minsk, 21 June 1979--The law of the Byelorussian Soviet Socialist Republic on confirmation of the Ukase of the Presidium of the Supreme Soviet of the Byelorussian SSR "On conversion of the Main Administration on Gasification attached to the Council of Ministers of the Byelorussian SSR to the State Committee of the Byelorussian SSR on gasification is published. The Supreme Soviet of the Byelorussian Soviet Socialist Republic decrees: confirm the Ukase of the Presidium of the Supreme Soviet of the Byelorussian SSR, dated 29 March 1979, "On conversion of the Main Administration on Gasification attached to the Council of Ministers of the Byelorussian SSR to the State Committee of the Byelorussian SSR for Gasification."] [Signed] I. Polyakov, chairman of the Presidium of the Supreme Soviet of the BSSR, and Ye. Chagina, secretary of the Presidium of the Supreme Soviet of the BSSR. [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 24 Jun 79 p 3] 6521

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